JOINING FORCES TO MAKE A DIFFERENCE IN STEM LEARNING

Marsha Semmel
Public Libraries & STEM Conference
Denver
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Learning Ecosystems
(KnowledgeWorks)

These changes point the way toward a diverse learning ecosystem in which learning adapts to each child instead of each child trying to adapt to school.
The STEM Learning Ecosystem
(The AfterSchool Alliance)

“Ecosystem for Learning”

- **Social Supports**
  - Parents
  - Friends
  - Educators

- **Learning Environments**
  - School
  - Afterschool & Summer
  - Home
  - Science Centers & others

- **Policy & Other**
  - Federal Policy
  - National Standards
STEM Learning as a Complex Challenge

How can we “mesh these contributions [family, friends, mentors, peers, school, church, clubs, libraries, museums, parks, etc.] synergistically rather than duplicatively while adapting models that have worked well in one place to the culture, governance, and idiosyncrasies in other settings?”

Martin Storksdieck,  
*STEM Learning is Everywhere*, NRC 2014
## “Complex”/”Wicked” problems

<table>
<thead>
<tr>
<th>SIMPLE</th>
<th>COMPLICATED</th>
<th>COMPLEX</th>
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</thead>
<tbody>
<tr>
<td><strong>Baking a Cake</strong></td>
<td><strong>Sending a Rocket to the Moon</strong></td>
<td><strong>Raising a Child</strong></td>
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<tr>
<td>The recipe is essential.</td>
<td>Rigid protocols or formulas are needed.</td>
<td>Rigid protocols have a limited application or are counter-productive.</td>
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<tr>
<td>Recipes are tested to assure easy replication.</td>
<td>Sending one rocket increases the likelihood that the next will also be a success.</td>
<td>Raising one child provides experience but is no guarantee of success with the next.</td>
</tr>
<tr>
<td>No particular expertise is required, but experience increases success rate.</td>
<td>High levels of expertise and training in a variety of fields are necessary for success.</td>
<td>Expertise helps but only when balanced with responsiveness to the particular child.</td>
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<tr>
<td>A good recipe produces nearly the same cake every time.</td>
<td>Key elements of each rocket must be identical to succeed.</td>
<td>Every child is unique and must be understood as an individual.</td>
</tr>
<tr>
<td>The best recipes give good results every time.</td>
<td>There is a high degree of certainty of outcome.</td>
<td>Uncertainty of outcome remains.</td>
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<tr>
<td>A good recipe notes the quantity and nature of the “parts” needed and specifies the order in which to combine them, but there is room for experimentation.</td>
<td>Success depends on a blueprint that directs both the development of separate parts and specifies the exact relationship in which to assemble them.</td>
<td>Can’t separate the parts from the whole; essence exists in the relationship between different people, different experiences, different moments in time.</td>
</tr>
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Evolving Evaluation/Impact Trends

- Program Outputs
- Program Outcomes
- Organization Impact--Public Value
- Collective Impact--System Effects
Perspectives on Outcome Based Evaluation for Libraries and Museums (IMLS, 2002)

“We believe that libraries have a profound impact on individuals, institutions, and communities. How can we engineer a measurement system that will verify our intuition?”

- Peggy D. Rudd
  - Director and Librarian, Texas State Library and Archives Commission
Shaping Outcomes
(www.shapingoutcomes.org)

**OUT PUTS**

*Outputs* can be thought of as counts of what the program produces. That is, *items or events*.

**examples:**
1. Trainer hired
2. 4 CDs produced
3. 17,889 Web site hits

**OUTCOMES**

*Outcomes* are the changes the program wants to see coming out of the participants or audiences. That is, changes in *people*.

**examples:**
Parents and children learn about astronomy from hands-on exhibit activities.
Logic Model

SITUATION

The context of the program
- organization’s mission
- audience needs

INPUTS

Resources a program uses

ACTIVITIES

Development & management tasks

SERVICES

Services to audiences

OUTPUTS

Quantity of work, products, and participants

OUTCOMES

Change in target audience in
- knowledge
- skill
- attitude
- behavior
- status
- condition

EVALUATION
From Program to Organization:
Creating Public Value, Mark Moore

Legitimacy and support perspective
What sources of legitimacy and support do we rely on and how can we increase legitimacy and support in the future?

Operational capacity perspective
How well and how reliably do our programs, policies and procedures work to create value and how can they be made more efficient and effective in the future?

Strategic public management

Public Value Account
What dimensions of public value do we produce and how can we produce more net value in the future?

Direction of policy development, implementation and impact

From: Recognising Public Value, Mark Moore, 2013
Looking at a System: Collective Impact

**From**
Organizations loosely collaborating while pursuing their own goals and metrics

**To**
Entities pursuing aligned goals and metrics to multiply their collective impact
## The Five Conditions of Collective Impact

<table>
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<tr>
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<th>Description</th>
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<tr>
<td>Common Agenda</td>
<td>All participants have a shared vision for change including a common understanding of the problem and a joint approach to solving it through agreed upon actions.</td>
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<tr>
<td>Shared Measurement</td>
<td>Collecting data and measuring results consistently across all participants ensures efforts remain aligned and participants hold each other accountable.</td>
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<tr>
<td>Mutually Reinforcing Activities</td>
<td>Participant activities must be differentiated while still being coordinated through a mutually reinforcing plan of action.</td>
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<tr>
<td>Continuous Communication</td>
<td>Consistent and open communication is needed across the many players to build trust, assure mutual objectives, and create common motivation.</td>
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<tr>
<td>Backbone Support</td>
<td>Creating and managing collective impact requires a separate organization(s) with staff and a specific set of skills to serve as the backbone for the entire initiative and coordinate participating organizations and agencies.</td>
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Community Alignment & Participation

The Harwood Index

FIVE STAGES OF COMMUNITY LIFE

The Harwood Index is a new feature of our work on building community strength. Communities can use the Index as a tool to help determine where they are in the Stages of Community Life and figure out how to move forward, and to plot their progress. (See www.harwoodinstitute.org for more details.)

The Harwood Index plots five communities going through the stages of Community Life. Other communities can use the Index as a tool to help determine where they are in the Stages of Community Life. It is not intended as a recipe to ensure a community’s success — instead, it is designed to be a compass by which communities make decisions about how to move forward.

Each of the five communities were plotted on the Harwood Index based on where they were in the Stages of Community Life when we visited their public capital. While their placements on the Index may change over time, each one is an example of what a stage of community life looks like at a single point in time. They also offer insights into the implications for strategies for moving forward.
The STEM Learning Ecosystem
(The AfterSchool Alliance)

“Ecosystem for Learning”

Learner

Social Supports
- Parents
- Friends
- Educators

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Policy & Funding Priority: Cross-Sector Collaborations (2014)

WORKING PAPER

How Cross-Sector Collaborations are Advancing STEM Learning

STEM learning opportunities harness unique contributions of educators, policymakers, parents, and others to support a comprehensive vision of science, technology, engineering, and math (STEM) education for all children. This paper highlights the attributes and strategies of these learning experiences throughout the country with the hope that others may see these lessons to improve STEM learning for many more of America’s children.

By: Kathleen Traynour & Becky Trull
FEBRUARY 2014

Emerging STEM Learning Ecosystems Profiled in this Report

1. AFTERCARE SUMMER SCHOLARS
Providence, RI
2. BOSTON SUMMER LEARNING PROJECT
Boston, MA
3. CALIFORNIA ACADEMY OF SCIENCES, SCIENCE ACTION CLUSTERS
San Francisco, CA
4. CENTER FOR THE ADVANCEMENT OF SCIENCE, EDUCATION, MUSEUM OF SCIENCE AND INDUSTRY
Chicago, IL
5. CHICAGO PRE-COLLEGE SCIENCE AND ENGINEERING PROGRAM
Chicago, IL
6. DETROIT AREA PRE-COLLEGE SCIENCE AND ENGINEERING PROGRAM
Detroit, MI
7. EXPANDED LEARNING NETWORK OF THE SOUTHERN TIER
Cattaraugus, NY
8. GIRLS START
Central Texas
9. INDIANA AFTER SCHOOL STEM INITIATIVE
Indiana
10. NEW YORK CITY STEM EDUCATORS ACADEMY
New York, NY
11. ORANGE COUNTY STEM INITIATIVE
Orange County, CA
12. SORK (SCHOOLS AND HOMES IN EDUCATION) AFTERSCHOOL PROGRAM
Carson and Ecuyer Hill communities, PA
13. SMILE (SCIENCE AND MATH INVESTIGATIVE LEARNING EXPERIENCES)
Oregon
14. SYNTHESIZE
Portland, Oregon
15. URBAN ADVANTAGE
New York, NY
DENVER, June 9, 2015 /PRNewswire/ -- The STEM Funders Network (SFN) announced today at the Clinton Global Initiative / Americas Conference that it has launched an ambitious STEM Ecosystem Initiative to catalyze the creation of robust communities of practice in support of STEM, (Science, Technology, Engineering, and Math.) The STEM Ecosystem Initiative will invite existing communities engaged in organized collaboration to apply for grants that will support the cultivation, scale and knowledge transfer of the best practices in building strong connections among a rich array of regional STEM assets with a vision to improve student performance in STEM fields and increase participation in STEM careers.
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System Leadership

- Ability to see the larger system
- Ability to foster reflection and generative conversations
- Shift from reactive problem solving to co-creating the future.
System Leadership, cont.

• Open mind

• Open heart

• Open will

• “Enable our collective intelligence and wisdom to emerge.”
Thank you very much!

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